

Claims:

1. A permanent magnet electric rotating machine comprising:

5 a stator performed a winding to a stator iron core;

plural permanent magnet insertion holes for forming magnetic pole piece portions at a side of said stator side through auxiliary magnetic pole portions;

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a rotor embedded plural permanent magnets in said permanent magnet insertion holes;

said rotor arranged to said stator with a rotation air gap; wherein

15 the permanent magnet electric rotating machine further comprising:

a magnetic gap is provided between at least one said permanent magnet and at least one said auxiliary magnetic pole portion which is adjacent to at least one 20 said permanent magnet to a peripheral direction.

2. A permanent magnet electric rotating machine according to claim 1, wherein

25 a dent portion is provided at a bottom portion of said permanent magnet, and

on said dent portion said permanent magnet is arranged.

3. A permanent magnet electric rotating machine according to any one of claim 1 and claim 2, wherein a non-magnetic material is arranged in said magnetic gap.

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4. A permanent magnet electric rotating machine according to any one of claim 1 to claim 3, wherein a peripheral direction width of said magnetic gap at a face of said stator side is formed larger than a peripheral direction width of said magnetic gap at a face of an anti-stator side.

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5. A permanent magnet electric rotating machine according to claim 4, wherein

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a peripheral direction cross-section of said magnetic gap is a triangular shape.

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6. A permanent magnet electric rotating machine according to any one of claim 1 to claim 5, wherein said magnetic pole piece portion is connected to said auxiliary magnetic pole portion through a bridge portion, and

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a stator side surface and an magnetic gap side surface of said bridge portion are substantially parallel.

7. A permanent magnet electric rotating machine according to claim 6, wherein

5 said bridge portion is formed to extend toward vertically to an inclined face of said magnetic gap.

8. A permanent magnet electric rotating machine comprising:

10 a stator performed a winding to a stator iron core;

15 plural permanent magnet insertion holes for forming magnetic pole piece portions at a stator side through auxiliary magnetic pole portions; and

a rotor embedded plural permanent magnets in said permanent magnet insertion holes;

15 said rotor arranged to said stator with a rotation air gap; wherein

the permanent magnet electric rotating machine further comprising:

20 a magnetic gap is provided between at least one said magnetic piece portion and at least one said auxiliary magnetic pole portion.

9. A permanent magnet electric rotating machine according to claim 8, wherein

25 said magnetic gap contacts to a peripheral direction end portion of a face of a stator side of said permanent magnet.

10. A permanent magnet electric rotating machine according to claim 9, wherein

 said magnetic gap extends toward an inner side of said permanent magnet.

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11. A permanent magnet electric rotating machine according to claim 9, wherein

 said magnetic gap extends with a rectangular shape toward an inner side of said permanent magnet.

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12. A permanent magnet electric rotating machine comprising:

 a stator performed a winding to a stator iron core;

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 plural permanent magnet insertion holes for forming magnetic pole piece portions at a side of said stator through auxiliary magnetic pole portions; and

 a rotor embedded plural permanent magnets in said permanent magnet insertion holes;

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 said rotor arranged to said stator with a rotation air gap; wherein

 the permanent magnet electric rotating machine further comprising:

 a magnetic gap is provided between at least one said magnetic piece portion and at least one said auxiliary magnetic pole portion, and

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5 said magnetic pole piece portion is fixed to said auxiliary magnetic pole portion through a non-magnetic magnetic pole piece supporting member.

10 13. A permanent magnet electric rotating machine according to claim 12, wherein

15 said magnetic pole piece supporting member has a shape and said magnetic pole piece supporting member is inserted from both axis end portions of said rotor iron core.

20 14. A permanent magnet electric rotating machine comprising:

25 a stator performed a winding to a stator iron core;

30 plural permanent magnet insertion holes for forming magnetic pole piece portions at a side of said stator through auxiliary magnetic pole portions; and

35 a rotor embedded plural permanent magnets in said permanent magnet insertion holes;

40 said rotor arranged to said stator with a rotation air gap; wherein

45 the permanent magnet electric rotating machine further comprising:

50 a magnetic gap is provided between at least one said magnetic piece portion and at least one said auxiliary magnetic pole portion,

a permanent magnet supporting member is arranged between said magnetic pole piece portion and said permanent magnet and said permanent magnet supporting member is assembled according to a magnetic material
5 and a non-magnetic material,

said magnetic material of said permanent magnet supporting member is arranged between said magnetic pole piece portion and said permanent magnet, and

10 said non-magnetic material of said permanent magnet supporting member is engaged with said magnetic pole piece portion.

15. A permanent magnet electric rotating machine according to any one of claim 8 to claim 14, wherein
15 a non-magnetic material is arranged in said magnetic gap.

16. A permanent magnet electric rotating machine according to any one of claim 1 to claim 15, wherein
20 a peripheral direction width of said permanent magnet is smaller than a peripheral direction width of said auxiliary magnetic pole portion.

25 17. An electromotive vehicle driven by a permanent magnet electric rotating machine according to any one of claim 1 to claim 16.